Spotlight on Sustaining Member

Janis Offers Two New Systems: Probes, Cryo-Free DRS

Janis Research Company is offering a new series of micro-manipulated probe systems with a rotatable magnetic field. The basic cryostat is based on the model ST-500 ultra low vibration microscopy system that was developed for high spatial resolution optical microscopy, providing outstanding sample positional stability. The typical vibration level is ± 25 nm and the long-term drift is approximately 2 nm/min.

This probe station is combined with two room temperature electromagnets. The magnets offer variable horizontal magnetic fields up to ~ 800 Gauss each in perpendicular directions. The maximum combined magnetic field is ~ 1,130 Gauss. Both magnetic fields can be ramped independently at rates of up to 30 Hz (with field limitation at the higher frequencies) using the special dual power supply. The power supply allows creating the rotatable magnetic field with the maximum rotation frequency of 30 Hz by synchronizing voltage provided to each electromagnet.

The probe station operates from 3K up to 475K, with an option up to reach up to 650K. The probe station can be used either with liquid helium or liquid nitrogen. The system can be provided with up to four low frequency or microwave (up to 67 GHz) probes or optical fiber probe arms.

The system is supplied with two cryogenic Hall probes and readouts to measure the precise value of the magnetic field at the chuck, and is supported on a floating vibration isolation table for quiet operation in a variety of lab environments. It also includes a high quality microscope and CCD camera and color monitor, with typical resolutions of 2 to 5 microns.

The system is ideal for the study of ferromagnetism of thin films, magneto-optical and magneto-electrical properties in a variety of experiments, including quantum dots, spintronic devices and nanoscale electronics.

Janis Research has also introduced its model JDry-500-TLSV top-loading cryogen-free dilution refrigerator (DR) system with sample in vacuum.

The JDry-500-TLSV top-loading cryogen-free dilution refrigerator.

A rigid top-loading sample probe, together with vacuum load-lock and gate valve, is provided with the system, and it can be used to load the sample in vacuum while the dilution refrigerator system remains cold.

Basic performance: sample base temperature: 20mK ~ 40mK depending on the wires and coaxial cables installed on the sample mount. Sample space: up to 2.0" in diameter. Re-cool down time to base T after sample change approximately 30 hours. Other features: rigid, robust, and reliable electrical contact.

This top-loading sample probe can also be used for "wet" DR systems with minor modifications. **www.janis.com**.

Equilibar Back Pressure Regulator Plays Key Role in Study

The Equilibar® back pressure regulator played a key role in a 2011 study conducted by The Harvard-Smithsonian Center for Astrophysics. The Harvard-Smithsonian Center for Astrophysics conducts research into all aspects of astronomy—including cosmology, galaxy exploration, and laboratory astrophysics—by 300 scientists from both Harvard University and the Smithsonian Institute.

In November, 2011, Equilibar was featured in a presentation showing its successful implementation in a Center for Astrophysics study that demonstrated a method to stabilize the temperature of astronomical sensors and thus improve their reliability. The presentation, authored by Harvard's Michael Smith and Equilibar's Jeff Jennings, was part of the American Society for Mechanical Engineering's 2011 International Mechanical Engineering Congress and Exposition in Denver.

In the study, "Cryogenic Temperature Stabilization of the Daikin 308 Cryocooler," an Equilibar precision back pressure regulator was used to stabilize cryogenic temperatures by controlling helium gas pressure in the range of 4 degrees kelvin. The study reported an increase in temperature stability of 66 percent.

Astronomical sensors are typically housed in a cryostat, which is an apparatus for maintaining a very low temperature. The cryostat keeps them near absolute zero temperature to provide more precise output signals. The traditional method of maintaining cryostat temperature is to circulate helium at about 350 psig and 4 kelvin from a cryocooler. The baseline performance for this experiment, determined by using the Daikin 308 cryocooler to circulate the helium, showed temperature variability of 0.052K (range of 4.183 to 4.235K).

The Equilibar was installed to improve the pressure stability of helium in the cryostat. Because the Equilibar is a dome-loaded back pressure regulator, a static helium cylinder was used to provide a stable set-point signal. A portion of the helium stream is allowed to bypass the cryostat and return directly to the compressor. This maintains the pressure of the helium in the cryostat—and therefore the temperature—at a more stable value. Temperature variability was reduced to 0.023K (4.300K to 4.277K) by using the Equilibar. The astronomical sensor housed in the cryostat showed a similar reduction in power output variability as a result of the improved temperature stability.

The Equilibar back pressure regulator is shown (center) in front of the helium–cooled cryostat (background).

Instrument power variability was reduced from 0.011 watt (0.587 to 0.598 W) to 0.006 watt (0.573 to 0.579). "Our back pressure regulators are highly sensitive with virtually no dead-band or hysteresis," said Equilibar President Jeff Jennings. They are offered in pressure ranges from less than 1 psi to 5000 psig. The Instrument Series BPR used in this application had a stainless steel 316 body with a PTFE diaphragm. Potential applications for this improved temperature scheme are sensors such as those used in the Submillimeter Array operated by the Smithsonian Astrophysical Observatory in Mauna Kea, Hawaii. The Submillimeter Array explores the universe by detecting light of colors not visible to the human eye. Detecting submillimeter emission is vital for studying star formations and exploring galaxies outside our own. The Submillimeter Array is capable of acquiring detailed images where optical telescopes can see nothing but darkness.

Learn more about Equilibar back pressure regulators at **www.equilibar.com**.